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The impact of point source pollution on shallow groundwater used for human consumption in a threshold country

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Abstract:

Many developing and threshold countries rely on shallow groundwater wells for their water supply whilst pit latrines are used for sanitation. We employed a unified strategy involving satellite images and environmental monitoring of 16 physico-chemical and microbiological water quality parameters to identify significant land uses that can lead to unacceptable deterioration of source water, in a region with a subtropical climate and seasonally restricted torrential rainfall in Northern Argentina. Agricultural and non-agricultural sources of nitrate were illustrated in satellite images and used to assess the organic load discharged. The estimated human organic load per year was 28.5 BOD(5) tons and the N load was 7.5 tons, while for poultry farms it was 9940-BOD(5) tons and 1037-N tons, respectively. Concentrations of nitrates and organics were significantly different between seasons in well water (p values of 0.026 and 0.039, respectively). The onset of the wet season had an extraordinarily negative impact on well water due in part to the high permeability of soils made up of fine gravels and coarse sand. Discriminant analysis showed that land uses had a pronounced seasonal influence on nitrates and introduced additional microbial contamination, causing nitrification and denitrification in shallow groundwater. P-well was highly impacted by a poultry farm while S-well was affected by anthropogenic pollution and background load, as revealed by Principal Component Analysis. The application of microbial source tracking techniques is recommended to corroborate local sources of human versus animal origin.

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Resource Description

Exposure : ⊠

weather or climate related pathway by which climate change affects health

Extreme Weather Event, Food/Water Quality

Extreme Weather Event: Flooding

Food/Water Quality: Chemical, Pathogen

Geographic Feature: ⊠

resource focuses on specific type of geography

Valley, Other Geographical Feature

Other Geographical Feature : subtropical;peri-rural

Geographic Location: ☒

resource focuses on specific location

 Non-United States

Non-United States: Central/South America

Health Impact: ☒

specification of health effect or disease related to climate change exposure

 Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease: General Foodborne/Waterborne Disease

Resource Type: ☒

format or standard characteristic of resource

 Research Article

Timescale: ☒

time period studied

 Time Scale Unspecified

Vulnerability/Impact Assessment: ☒

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

 A focus of content